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Music Theory Metacognition: How Thinking About Thinking Improves Music Learning

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To the Graduate Council:

I am submitting herewith a thesis written by Jillian Vogel entitled "Music Theory Metacognition: How Thinking About Thinking Improves Music Learning." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Music, with a major in Music.

Barbara Murphy, Major Professor

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Brendan McConville, Nathan Fleshner

Accepted for the Council:

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Vice Provost and Dean of the Graduate School

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Music Theory Metacognition: How Thinking About Thinking Improves Music Learning

A Thesis Presented for the
Master of Music
The University of Tennessee, Knoxville

Jillian Rose Vogel
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ABSTRACT

Academic researchers have discovered that students need a foundation of factual knowledge, an understanding of conceptual ideas, and organization skills to facilitate the retrieval of knowledge in order to best learn a topic. (Bransford, Donovan, & Pellegrino 1999, p. 21). When any of these three key aspects of learning are missing, students fail to learn a topic. In order to achieve these three goals for learning, professors can incorporate metacognitive activities in their classroom.

The two goals of this thesis were: 1) to conduct a study that evaluates music students' self-awareness of metacognitive abilities while learning, and based on the results, 2) to propose specific activities that music theory instructors can use to leverage these metacognitive abilities in the classroom. I first offer a framework of definitions and research conducted on metacognition and metacognitive awareness. I then describe the Metacognitive Awareness Inventory (MAI), a survey that measures awareness of metacognition that was given to undergraduate and graduate music students at the University of Tennessee. I then discuss the survey results to determine how metacognition can be used in music theory classrooms.

Table of Contents

1.Introduction and General Information	1
2.Literature Review	4
Defining Metacognition.....	4
Metacognition in Education Research.....	12
Metacognition in Music.....	14
3.Materials and Methods	19
The Apparatus.....	19
The Procedure	23
The Participants	24
4.Results and Discussion	25
The Metacognitive Awareness Inventory Results	25
5.Conclusions and Recommendations	35
Introduction	35
Knowledge about Cognition	35
Regulation of Cognition.....	42
Conclusion	47
List of References.....	48
Appendix.....	54
Vita.....	68

LIST OF FIGURES

Figure 2.1. Concept Map to Organize Metacognition	11
Figure 2.2. Regulatory checklist created by Schraw.....	13
Figure 4.1. Histogram of the Frequency of Overall Percentages.....	28
Figure 4.2. Histogram of Evaluation Scores	30
Figure 4.3. Mann-Whitney U Test	32

LIST OF TABLES

Table 4.1. Descriptive Statistics for the MAI	26
Table 4.2. Shapiro-Wilk Test on the MAI Data	27
Table 4.3. Kruskal-Wallis Test Data	29
Table 4.4. Kruskal-Wallis Test	31
Table 4.5. Table Demonstrating the Order of Awareness	33

LIST OF EXAMPLES

Example 5.1. Cadential Movement.....	36
Example 5.2. SATB Composition Exercise.....	39
Example 5.3. Chordal Movement in <i>Etude No. 12</i>	40
Example 5.4. Incorrect F Harmonic Minor Scale.	43
Example 5.5. Incorrect C# Harmonic Minor Scale.....	43
Example 5.6. Student Example of Secondary Dominant Chords.	45
Example 5.7. Good Example of First Species Counterpoint.....	46
Example 5.8. Bad Example of First Species Counterpoint.....	46

1. INTRODUCTION AND GENERAL INFORMATION

Consider the following scenario: In a music theory classroom, a teacher presents a lecture on major scales. At the end of class, the professor asks students to create a major scale. One student is unable to create the scale and can only regurgitate some aspects of major scales presented by the professor. One possible reason for this student's struggle with the topic is a lack of sufficient metacognitive skills. The student in this scenario is not controlling their ability to adequately reflect on the information that is being presented to them. If the student more effectively utilized metacognitive skills, they would have realized that there were some aspect of major scales that they did not fully grasp and could have asked a question to clarify their confusion. Furthermore, the student could have concurrently absorbed and reflected on the lectured material, metacognitively triggering an important response, such as an awareness of needing to ask a question for clarification, to deepen the student's learning.

Metacognition, or thinking about thinking (Flavell, 1979, p. 906), is a crucial skill for optimizing people's learning. Metacognition is the knowledge a student has about how they learn. Scholarship flourished on this topic and its' influence on education for nearly a half of a century. Metacognitive skills in education have dealt with a variety of topics such as how people have learned, how the curriculum was designed, what assessments were used, and what kinds of learning environments were created. In one such study, researchers asked the

question, "What research and development could help incorporate the insights from the report into classroom practice?" (Bransford, Donovan, & Pellegrino 1999, p. 1). These researchers found professors noticed a disconnect between students and their ability to comprehend concepts due to the students' preconceived notions about the world around them that limited their ability to fully grasp new material that challenges those beliefs (Bransford, Donovan, & Pellegrino 1999, p. 11). Bransford, Donovan, and Pellegrino suggest that metacognitive skills could have been incorporated to bridge the disconnect and help the students overcome their preconceived notions that their study found. Metacognitive skills are the tools people implemented to strengthen their learning and could be anything from rereading confusing passages, to highlighting important information, or creating a concept map for a new topic. To support using metacognition to enhance learning, metacognitive skills are necessary.

The goal of this thesis was to better understand what metacognitive abilities music students generally possess, thereby informing music theory instruction. This goal was achieved through a discussion of (1) relevant background literature, (2) an original research study conducted on music students at the University of Tennessee, Knoxville, (3) an analysis and discussion of the study's results, and (4) an application of the study's results through proposed classroom discussions, topics, and activities.

Chapter 1 of this thesis offers a selected literature review on the subject of metacognition as well as its application to the subjects of educational research

and music education research. Chapter 2 outlines the methodology for the current study. Chapter 3 presents the data from the Metacognitive Awareness Inventory. Chapter 4 proposes responses to the data with possible activities for music theory professors to implement to strengthen weaker areas of metacognition for music theory students. Finally, Chapter 5 concludes the thesis by presenting activities that incorporate metacognition in music theory exercises.

2.

LITERATURE REVIEW

This chapter presents a literature review to define metacognition and the research surrounding it. More specifically, this literature review seeks to achieve three goals: (1) to define metacognition and all the vocabulary surrounding metacognition with a specific focus on John Flavell's research, which was the foundation of metacognition, (2) to explore the research that has been conducted in educational settings, and (3) to present the research on metacognition in relation to music. The aggregate of these scholarly foundations provide a framework for my research into how metacognitive skills can inform music theory instruction. This literature review first, defines metacognition, and second, explores the research that has been conducted in educational settings. Lastly, this literature review presents research on metacognition in relation to music.

Defining Metacognition

Metacognition has often been defined as 'thinking about thinking' or the ability to recognize through self-awareness one's strengths and weaknesses when learning something. When using metacognitive skills, students are able to take control of their learning through applying strategies to the topic they are learning. In more technical terms, John Flavell (1979) defines metacognition as "cognition about cognitive phenomena" (p. 906). Flavell (1976) states, "Metacognition refers to one's knowledge concerning one's own cognitive

processes and products or anything related to them" (p. 232). Hennessey (1999) defines metacognition as an "awareness of one's own thinking, awareness of the content of one's conceptions, an active monitoring of one's cognitive processes, an attempt to regulate one's cognitive processes in relationship to further learning, and an application of a set of heuristics as an effective device for helping people organize their methods of attack on problems in general" (p. 3). Kuhn and Dean (2004) define metacognition as an "awareness and management of one's own thought" (p. 270). Martinez (2006) defines metacognition as "the monitoring and control of thought" (p. 696). Chick defines metacognition as a critical awareness of one's thinking and learning and oneself as a thinker and learner (n.d., para. 1). Each definition of metacognition provides a variant for the most regularly occurring definition of 'thinking about thinking' or the awareness one has of their learning.

In addition to having multiple ways to define metacognition, there are multiple words that mean metacognition. These terms include metamentation (Bogdan, 2000, p. xi), self-management for metacognition (O'Neil and Speilberger, 1979, p. 73), and meta-learning (Maudsley, 1979, p. 1). All of these terms, including metacognition, involve the process of regulating ones' learning. In order to do this, one must have an idea of how they personally learn. While each term describes the same aspect of learning, this thesis only uses the term metacognition.

Regulating learning is necessary for metacognition. Metacognitive regulation is any way a person can monitor their learning. In order to regulate one's own learning, they must have an understanding of how they best learn. There are three types of metacognitive regulation described by Flavell: metacognitive knowledge, metacognitive experiences, and metacognitive skills. Flavell, Miller, and Miller (2002, p. 263) found that metacognitive knowledge is explicit, conscious, and factual knowledge about the importance of person, task, and strategy variables. Metacognitive knowledge is what a person knows about their own cognitive process, or how they best learn. It refers to the processes used to plan, monitor, and assess one's understanding and performance. Metacognitive knowledge is what individuals know about themselves as cognitive processors, about different approaches they use for learning and problem solving, and about the demands of a particular learning task.

Flavell further divides metacognitive knowledge into three sub-categories: procedural knowledge, conditional knowledge, and declarative knowledge. Declarative knowledge refers to knowing "about" things and is factual knowledge about topics. For instance, declarative music theory knowledge might be factual information on the history treatise publication that charted the art of counterpoint. Researchers found that declarative knowledge is what learners know about their own memory and indicates that adults have more knowledge than children about the cognitive processes associated with memory (Baker, 1989, p. 5). For this

reason, declarative knowledge within metacognition is an ideal type of knowledge for adult music learners.

Procedural knowledge is knowing "how" to do things and is the knowledge of the steps necessary to complete a task. For instance, procedural music theory knowledge might be knowing the steps to apply Roman Numeral's to analyze a piece of music. Researchers found individuals with a high degree of procedural knowledge perform tasks more automatically, are more likely to possess a larger repertoire of strategies, and are more likely to sequence strategies effectively (Pressley, Borkowski, & Schneider, 1987, pp. 89-129). This research applied to music theory learning shows the importance of procedural knowledge for understanding how to analyze music in ways that are appropriate.

Conditional knowledge is knowing the "why" and "when" aspects of learning. For example, in a music theory classroom, conditional knowledge is knowing that Roman numeral analysis is not ideal for analyzing Philip Glass' music as this music does not follow harmonic progressions, and, therefore, a different form of analysis would be more successful to provide analytical insight on the piece. Research shows conditional knowledge is important because it helps students selectively allocate their resources and use strategies more effectively (Reynolds, 1992, p. 371).

Flavell's second type of metacognitive regulation is metacognitive experiences. Flavell (1979) stated, "Metacognitive experiences are conscious cognitive or affective experiences that occur during the enterprise and concern

any aspect of it—often, how well it is going” (p. 906). Metacognitive experiences are often linked with emotions, which are used as a tool to decipher how the learning is going. For example, a student’s frustration could lead to self-detection of the learning experience not working best for the student. Alternatively, if a student is feeling positive while learning, then that feeling could help the student realize that the learning strategy they are using is working.

Cognitive monitoring is a way to process learning and is used with aspects of metacognition to combine metacognitive knowledge and metacognitive experiences to help learners achieve their goals (Flavell, 1979, p. 908). The model is centered around three types of knowledge variables: person, task, and strategies. Each variable contributes to metacognitive experiences. Task variables are what a person knows about a task and what is required to complete it. Strategy variables are what a learner already has available to themselves to help them complete a task. Person variables are what a learner realizes are their strengths or weaknesses when trying to complete a task. For metacognition, each category of learning affects aspects of metacognition and the various ways people learn.

The third type of metacognitive regulation of metacognition is metacognitive skills. Metacognitive skills are strategies that help strengthen one's learning of a topic. There are many types of strategies, including debugging (e.g. asking questions to clear up confusion), information management (e.g. sequencing and processing information), and reflection (e.g. which allow a

learner to better process new information by analyzing how well they learned something after the learning has occurred). Metacognitive skills are as simple as asking a question to better understand a topic or are as complex as creating a concept map.

Each metacognitive skill helps a student better learn a topic. All three categories must be used in order to learn using metacognition: metacognitive knowledge, metacognitive experiences, and metacognitive skills. For example, a student uses metacognition when they think about how they best learn, implement those strategies into their learning, and reflect on whether those chosen strategies are helping them learn in the best way.

Metamemory is a type of metacognitive skill and is knowledge about memory functioning, difficulties, and strategies. Flavell and Wellman (1977, pp. 3-33) created two metamemory categories: sensitivity and variables. Sensitivity is the implicit, unconscious behavioral knowledge of when memory is necessary. Variables are the explicit, conscious, and factual knowledge about the importance of person, task, and strategies for memory performance. Metamemory strengthens metacognition skills when both categories are used together. For example, a student might realize that they are struggling with remembering music terms. They could use their metamemory to think about what metacognitive skills previously helped them remember music terms, such as a mnemonic device, and apply that strategy to the terms they are currently trying to learn.

Metacognitive regulation, which is necessary for metacognition, helps students process their learning. Flavell (1979) argued, “Metacognitive regulation is adjustments individuals make to their learning processes to help control their learning, such as planning, information management strategies, comprehension monitoring, de-bugging strategies, and evaluation of progress and goals” (p. 911). Planning is setting goals prior to learning. For music theory learning, an example of planning would be setting a goal to analyze a piece of music by the end of one’s third music theory semester and setting smaller goals along the way to help reach the goal. Information management strategies, as defined previously, are the skills used to process information more efficiently. For music theory learning, an example of this could be a learner creating their own examples of parsimonious triadic relationships to make Neo-Riemannian theory more meaningful. Debugging strategies are ways to correct performance errors. A music theory example of this is a learner not understanding minor scales, so the learner changes strategies for learning minor scales. Evaluation is the analysis of a strategy’s effectiveness after learning something. An example of this for music theory learning is a student summarizing what they learned after class. Planning, information management strategies, comprehension monitoring, de-bugging strategies, and evaluation are each pieces of metacognitive regulation.

The first section of the literature review presented definitions of metacognition with all that it entailed. To simplify the various definitions and

keywords shown and to demonstrate the purpose of concept maps, a concept map showing how each piece of metacognition is related is shown in Figure 2.1.

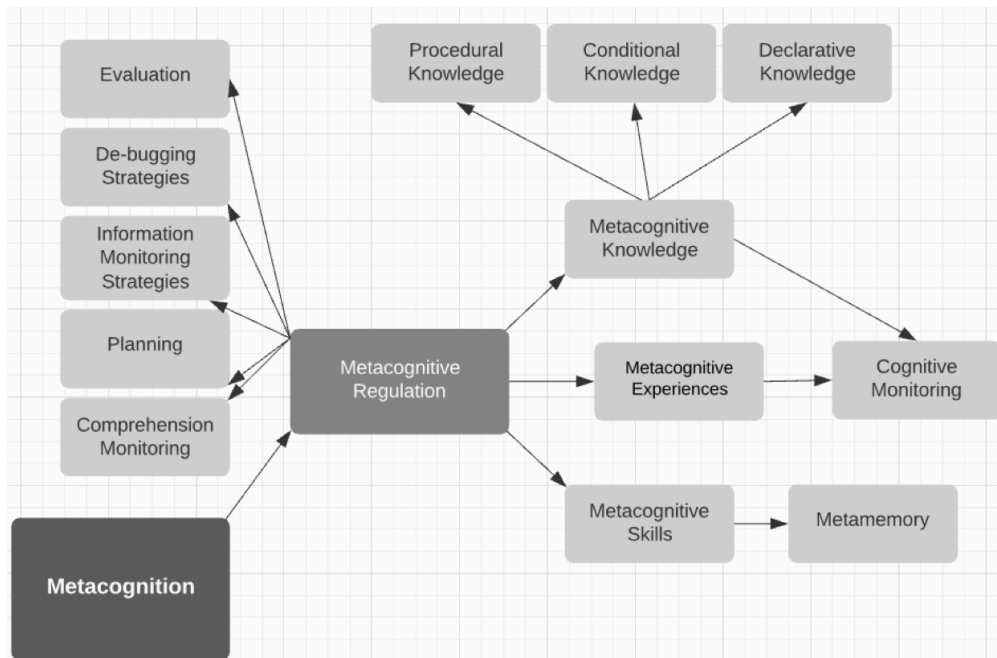


Figure 2.1. Concept map to organize metacognition.

Metacognition in Education Research

Research in education shows that metacognition is a crucial aspect of learning. Flavell (1979, p. 906) believed metacognition plays an important role in communication, oral persuasion, oral comprehension, reading comprehension, writing, language acquisition, attention, memory, problem solving, social cognition, and various types of self-control and self-instruction.

Research shows that metacognition is vital for self-education. Garofalo and Lester (1985, p. 163) suggest that teachers should be able to help students in the development of questioning in a way that required reflection on their own thinking process and their future course of action. Eaton and Dembo (1997, p. 434) propose that teachers use questions such as "why" and "what can you do to answer more exercises correctly" to encourage metacognitive thinking in the classroom. Shraw (1998, p. 121) offers the regulatory checklist for students to check in with their learning in order (Figure 2.3) to “enable novice learners to implement a systematic regulatory sequence that helps them control their performance” (Shraw, 1998, p. 121).

A Regulatory Checklist:

Planning

1. What is the nature of the task?
2. What is my goal?
3. What kind of information and strategies do I need?
4. How much time and resources will I need?

Monitoring

1. Do I have a clear understanding of what I am doing?
2. Does the task make sense?
3. Am I reaching my goals?
4. Do I need to make changes?

Evaluation

1. Have I reached my goal?
2. What worked?
3. What didn't work?
4. Would I do things differently next time?

Figure 2.2. Regulatory checklist created by Schraw.

One study by Paris and Ayres (1994, p. 10) found that students using metacognitive skills are less likely to blame others for their own shortcomings in their learning. Furthermore, the students that use metacognitive skills are less likely to think luck was the reason for their success, which allows students to take responsibility for their learning and understand the importance of their role in their learning. Their study utilizes self-reflection activities that include the students creating their own plans for improvement in order to have control of their learning.

Metacognition in Music

Some music theorists struggle with the vast amount of topics that need to be covered in a short period of time. Michael Rogers points out a consistent problem with the pacing of many undergraduate music theory curricula:

One irony of many undergraduate curriculums is that the two-or three-year required sequence of courses allots all its time to acquiring the background (terminology, labels, etc.) for doing music theory but runs out of time just as the topic becomes interesting—resulting in an extended introduction that leads nowhere. Under such conditions of all motion and no arrival, students are never exposed to what real theory is all about and carry with them a biased and limited notion of the subject. Music theory, in my opinion, is not a *subject* like pharmacy with labels to learn and prescriptions to fill, but it is an *activity*—more like composition or performance. The activity is *theorizing*: i.e., thinking about what we hear and hearing what we think about—and I would include even thinking about what we think. (Rogers, 1984, p. 4)

Rogers inadvertently ties music theory learning to metacognition through the use of the same definition – “thinking about what we think.” Specifically, Rogers' research demonstrates that in order to theorize about music, musicians must think about their thinking and hearing to properly process the information the music is supplying.

Metacognition research within the discipline of music is mostly focused on music performance studies. One of the leading researchers, Carol Benton (2014), wrote, “Music learning involves acquisition of knowledge and skill in cognitive, psychomotor, and affective domains of learning” (p. 21). Benton believed that within the cognitive domain, music learning stems from content knowledge and analysis of music; within the psychomotor domain, all musicians

need motor skills to perform; and within the affective domain, musicians use musical expression to communicate with their audience.

Benton's research explored what metacognition looks like in the music theory classroom. She stated (Benton, 2014), "Metacognition is manifested in awareness of personal strengths and weaknesses, related to music-learning tasks. Imagine a student in a beginning music theory class who is being introduced to ear training. She finds that her aural analysis of triads is very good. She is almost always accurate in identifying major, minor, diminished, and augmented triads via aural perception" (p. 30). Benton further explained that when the student struggled to identify intervals, she choose to devote more time to those intervals. This research demonstrated the importance of metacognitive skills when practicing aural identification. By having a metacognitive awareness of their learning process and an understanding of what tools are needed to correct the errors, students were able to progress with self-learning outside of the classroom.

Some studies have been conducted on metacognitive skills in music learning. Lenore Pogonowski's research found that students achieve musical success when they use metacognitive skills to learn about music (Pogonowski, 1989, p.11). Marilyn Eagan (1995, p. 11) found that students in musicianship classes benefitted from the use of metacognitive activities, such as self-reflection, to adapt the class to their individual needs. The students were taught how to use metacognitive skills and were instructed on how to figure out their

learning preferences. Eagan determined that the students' increased musicianship skills correlated with the incorporation of metacognition in her musicianship class. Another study, conducted by Sandra Mathias (1997, p. 65), found that elementary school students using self-assessment when pitch matching positively affected their acquisition. She discovered that students who played match games and self-assessed while learning increased how well they scored. She found that 42% of the first grade students and 63% of the third through fifth grade students accurately self-assessed their weaknesses in pitch matching. Mathias' research offered a solution for aural skills learning and pitch identification.

In an unpublished study conducted by Noa Kageyama (n.d., para. 21), a performance psychologist, results showed that novice guitar and piano students performed pieces better when the students used metacognitive skills to learn their music. The study divided a group of teachers into a control group which used the traditional teaching style and a test group of teachers that had been trained on using metacognitive skills in their teaching. The teachers then taught in their assigned styles for two weeks, which included focused instruction on planning (i.e., analyzing a piece before and verbalizing strategies to learn sections of the piece), playing (i.e., playing the music while simultaneously actively listening), evaluation (i.e., identify successes and failures and strategies effectiveness), and new strategies (i.e., new ways to approach the music). After the two weeks, the students were given a new piece to prepare. The students

were recorded performing and the recordings were scored by professional musicians on a scale of 1 to 7. The scores showed that the students who learned the music with metacognitive skills outperformed the other students in two categories: rhythm and musicality. Furthermore, the test found that when the teachers started teaching the test group using metacognition, the test group's scores drastically increased.

Further studies have been conducted on the use of metacognitive music skills with older performers. Hallam (2001, p. 1) found that professional musicians use metacognition to a greater degree than beginner musicians. Hallam (2001) wrote, "A musician requires considerable metacognitive skills in order to be able to recognize the nature and requirements of a particular task" (p. 3). Performers need metacognitive skills in order to determine which parts of a piece need to be practiced more than others. Higher level musicians utilize metacognitive skills in order to prepare pieces in less time and with less practice. Similarly, when learning music theory, musicians need metacognitive skills in order to apply the topics to their music learning in quicker, higher level ways.

Metacognition, or 'thinking about thinking,' is an important aspect of learning as shown in the research referenced. The importance of metacognition has been studied across many research disciplines such as psychology and education. While the research conducted on metacognition in music was sparse, each study supported the hypothesis that metacognition is important for learning.

For music theory learning, metacognition often falls under the category of cognitive learning which can be strengthened with metacognition.

3.

MATERIALS AND METHODS

The Apparatus

In order to discover what metacognitive skills music students possess and use, a survey was administered to graduate and undergraduate music majors at the University of Tennessee. The survey consisted of two parts: the Metacognitive Awareness Inventory (see Appendix A) and the demographics form (see Appendix B). The Metacognitive Awareness Inventory (MAI) is a survey that measures the respondent's metacognitive skills through 52 self-reporting true or false questions. The MAI was created by Schraw and Dennison to quantify a participant's individual metacognitive awareness. One point is given for each true answer (i.e., the respondent relates to this question) and no points are given for each false answer (i.e., a statement which the respondent does not identify with). An example of a question from the survey is: "I ask myself periodically if I am meeting my goals." The questions on the survey cover topics in two categories: knowledge about cognition and regulation of cognition.

The MAI divides knowledge about cognition into the categories of declarative knowledge, procedural knowledge, and conditional knowledge. Each category describes aspects of knowledge about cognition. On the survey, eight questions (question 5, 10, 12, 16, 17, 20, 32, and 46) measure declarative knowledge, or knowing what factual knowledge a learner needs in order to think critically. An example of a declarative knowledge question is, "I understand my

intellectual strengths and weaknesses.” Four questions (questions 3, 14, 27, and 33) measure procedural knowledge, or knowing how to use learning procedures and processes for completing tasks. An example of a procedural knowledge question is “I am aware of what strategies I use when I study.” Five questions (questions 15, 18, 26, 29, and 35) relate to conditional knowledge, or knowing when and why to use learning procedures. An example of a conditional knowledge question is “I know when each strategy I use will be most effective.” In total, there are 17 questions about knowledge of cognition or roughly 33% of the survey.

The second category of questions on the survey is regulation of cognition, or the monitoring of one’s cognition. Regulation of cognition questions account for 35 out of 52 questions on the MAI, or 67% of the questions. The MAI measures regulation of cognition through questions in the subcategories of planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation.

Planning, or the allocation of resources prior to learning, is measured through seven questions (question 4, 6, 8, 22, 23, 42, and 45). An example of a planning question is “I think about what I really need to learn before I begin a task.” Students use the planning phase to figure out what is needed to be successful with the learning task.

Information management strategies, or skills used to process information more efficiently, are measured through ten questions (questions 9, 13, 30, 31 ,37,

39, 41, 43, 47, and 48), the most questions on the survey for any sub-category (19% of the questions on the survey). An example of an information management strategies question is “I slow down when I encounter important information.” Information management strategies help students pace their learning and prioritized aspects of what they are trying to learn.

Comprehension monitoring, or assessment of one’s learning or strategy use, is measured through seven questions (questions 1, 2, 11, 21, 28, 34, and 49). An example of comprehensive monitoring question is “I ask myself periodically if I am meeting my goals.” Comprehension monitoring is important for students to ensure that they are keeping the learning pace they set for themselves.

Debugging strategies, or strategies to correct comprehension and performance errors, are measured through five questions (questions 25, 40, 44, 51, and 52). An example of a debugging strategy question is “I stop and re-read when I get confused.” Debugging strategies allow students to fix learning problems on their own without having to be corrected by a teacher.

The last category measured is evaluation, or the analysis of performance and strategy effectiveness after a learning episode. Evaluation is measured through six questions (questions 7, 19, 24, 36, 38, and 50). An example of an evaluation question is “I ask myself if there was an easier way to do things after I finish a task.” Evaluation is important for a student's future learning as it allows

students to take what they learned about their learning process and apply it to future tasks.

The MAI's validity has been demonstrated by its' creators, Schraw and Dennison. Schraw and Dennison conducted two experiments on the survey and found "the survey was reliable (i.e., $\alpha = .90$) and inter-correlated ($r = .54$)." The first study (Schraw & Dennison, 1994, p. 463) found that the MAI reliably measured knowledge of cognition and regulation of cognition. The second study (Schraw & Dennison, 1994, p. 466) was used to empirically measure the MAI in conjunction with test scores to determine whether higher metacognitive skills could be correlated with better academic achievement. In the second study, adults took five multiple choice reading comprehension tests, where the first was a practice test and the remaining four were graded to provide the researchers with academic scores to compare with the participant's MAI scores. Schraw and Dennison (1994) hypothesized that, "Higher scores on the MAI, indicating greater metacognitive awareness, should correspond to higher test performance, a greater awareness of one's own monitoring skills, and accurate monitoring of one's test performance." (p. 466) The results of the second study (Schraw & Dennison, 1994) showed that students' MAI scores were statistically related to their academic performance.

The MAI's validity and reliability was further demonstrated by several other researchers. First, Akin, Abaci, and Cetin (2007) surveyed 607 students and found that the internal consistency of the survey was .95 with correlations that

ranged from .35 to .65, making the survey valid and reliable (p. 1). Young and Fry (2008) demonstrated the validity of the MAI by correlating student scores with MAI survey results (p. 8). Their study found a correlation between GPA and knowledge of cognition and GPA and regulation of cognition proving the survey's validity.

In addition to completing the MAI, students answered several demographic questions such as age, type of music major, year in school, GPA, gender, if they were a double major, and employment status. The demographic questions were compared with students' MAI scores to evaluate if certain demographic aspects lent themselves to higher MAI scores: Do students with higher GPA's have higher metacognitive skills? Do students that have a double major or work full time in addition to being enrolled in school have higher metacognitive skills that allows them to study more efficiently? Are there metacognitive differences between graduate students and undergraduate students?

The Procedure

After this study was approved by the University of Tennessee IRB, a request to take the survey was sent via email to all undergraduate and graduate music students at the University of Tennessee (see Appendix C and Appendix D). Four reminders were sent to remind the students to take the survey. Students used Qualtrics survey and analysis software to take the survey; participants' data

was anonymous and all identifiers were removed. Students who took the survey were over 18 years of age and agreed to the conditions of the study (Appendix D). After the student answered the questions on the MAI and provided the demographic data, they were shown their scores on the MAI.

The Participants

Fifty-five students voluntarily participated in the survey of which forty-one were undergraduate students, thirteen were graduate students, and one person did not identify their program level. Of the survey participants, six had a 4.0 undergraduate GPA, twenty-three had a GPA between a 3.6 and 3.9, eight had a GPA between a 3.1 and 3.5, eleven had a GPA between a 2.6 and 3.0, one had between a 2.0 and 2.5, and no one had a GPA below 2.0. The demographics form asked for the students' employment status, gender, major instrument, secondary major, hours enrolled in school, and age. Since the sample size for most of the demographic information was too small for the results to be valid, only the students' employment was used in the analysis. While the employment status was divided on a scale on the survey, for this test employment status was only categorized as employed or unemployed. Of the fifty-five participants, seventeen were unemployed and thirty-eight were employed.

4.

RESULTS AND DISCUSSION

The Metacognitive Awareness Inventory Results

In order to discover students' metacognitive awareness, the Metacognitive Awareness Inventory (MAI), which measured knowledge about cognition and regulation of cognition, was administered in the survey. Each section's overall possible score was different, so the data was analyzed as a percentage instead of out of a total number.

Initially, descriptive statistics were run on the results from the MAI (See Table 4.1). Descriptive statistics quantitatively summarized a collection of data. The descriptive statistics were used to determine the minimum score participants received for each section of the MAI, the maximum score students received for each section of the MAI, the mean (the sum of the scores divided by the number of scores), the median (the middle value), and the standard deviation (the amount of variation in the scores).

Table 4.1: Descriptive Statistics for the MAI.

	Minimum	Maximum	Mean	Median	Standard Deviation
Declarative Knowledge	13	100	75.68	87.5	24.464
Procedural Knowledge	25	100	79.09	75	23.942
Conditional Knowledge	20	100	79.27	80	20.715
Planning	0	100	62.6	57.14	25.43
Information Management Strategies	40	100	78.91	80	17.498
Comprehension Monitoring	29	100	73.25	71.42	21.831
Debugging Strategies	60	100	89.09	100	13.78
Evaluation	0	100	68.18	66.67	26.308

The descriptive statistics provided no insight into students' metacognitive abilities. For this reason, more comprehensive tests needed to be run on the data.

Preliminary parametric tests were administered on the data extracted from the MAI, but, after looking closer at the data, it was determined that parametric tests could not be used. Parametric tests assume that the data has a known distribution or known parameters that defined them (Sprent & Smeeton, 2001, p. 7). The data from the MAI was not normally distributed, so nonparametric tests

were required. A nonparametric test is able to analyze data that is not ordinal and can be used for non-normally distributed data (Sprent & Smeeton, 2001, p. 8).

The first test performed was the Shapiro-Wilk test, used to determine whether or not the data was normally distributed (Sprent & Smeeton, 2001, p. 106). The test was used to determine if the sample met the criteria to assess linear correlation between variables. The Shapiro-Wilk test showed that, except for the sum on the values, the scores were not normally distributed. This result was determined by examination of the p -value, which is defined (Ott & Longnecker, 2001) as, “The probability of obtaining a value that is as likely or more likely to reject the Null Hypothesis as the actual observed value of the test statistic” (p. 224), or, more informally, can be described as the probability that something stranger than what was observed can occur. Table 4.2 shows the results of the Shapiro-Wilk test.

Table 4.2: Shapiro-Wilk Test on the MAI data.

Shapiro Wilkes Test for Normality							
Knowledge				Regulation			
Dec	Proc	Cond	Plan	Info	Comp	Debu	Eval
0.002	<.001	<.001	0.016	<.001	<.001	<.001	<.001

The confidence level for the Shapiro-Wilk test was set at 95%. The critical value, or rejection region, for this test was $1 - \text{the confidence level}$, making the p -value 0.05 ($1 - 0.95$). If the test result was lower than the critical p -value, then the hypothesis was rejected. The score for the total MAI score for this test was 0.197, so the null hypothesis was not rejected (compared to the other scores which are all lower than 0.05). In this case, the hypothesis was that the total score data was normally distributed and the p -value supported this hypothesis, but a histogram of the total scores demonstrated a slight left skew, making the data non-normally distributed. Figure 4.1 is a histogram of the data demonstrating the slight left skew of the frequency of overall percent scores.

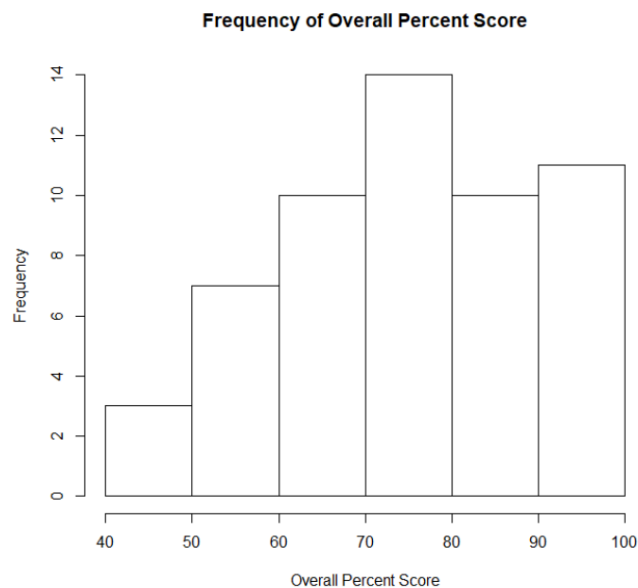


Figure 4.1: Histogram of the frequency of overall percentages

Because the individual score data was non-normally distributed, non-parametric tests were required to determine meaningful correlations from the data from the MAI with the data from the demographics form. The first demographic data analyzed was the results of the scores from undergraduate and graduate students. In order to test the hypothesis that two samples were drawn from identical distributions (or have the same central tendency and variation), the Kruskal-Wallis test was used (Ott & Longnecker, 2001, p. 410). Table 4.3 shows the data from the Kruskal-Wallis test.

Table 4.3: Data comparing undergraduate and graduate students' MAI scores with their MAI scores using the Kruskal-Wallis test.

	Group Statistics							
	Dec	Proc	Cond	Plan	Info	Comp	Debu	Eval
Undergraduate Mean	79.40	79.17	79.05	61.56	78.30	72.11	88.57	68.25
Graduate Mean	79.81	78.85	80.00	65.93	80.77	76.92	90.77	67.95
Kruskal-Wallis P-Value	0.82	0.62	0.91	0.22	0.74	0.46	0.85	0.02

For this data, the null hypothesis of the Kruskal-Wallis test was that there was no significant difference in the distribution of results from undergraduate and graduate students (i.e., the data was drawn from the same population). At a 95%

confidence level, the p -values from the tests suggested that the undergraduate and graduate students' MAI scores have no significant difference, except for in the evaluation category ($p < .02$) under the regulation of cognition section. The mean scores for evaluation were similar numerically, but a histogram of the scores demonstrated that the graduate students had a larger range of scores, but with a higher percentage of scores being in the range of 80-100% than the undergraduate scores (Figure 4.2).

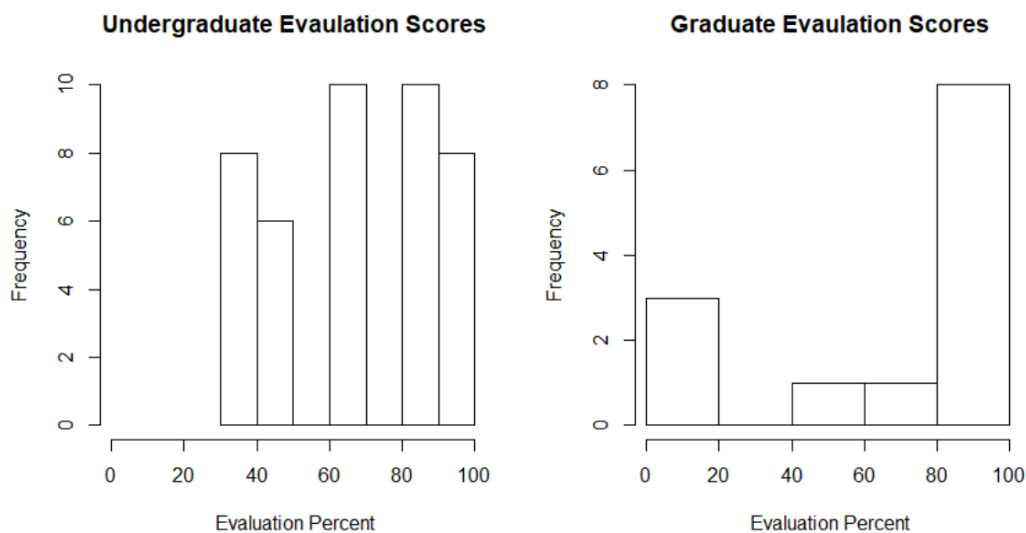


Figure 4.2: Histogram of evaluation scores for undergraduate and graduate students.

Overall, the scores did not show a significant difference between undergraduate and graduate students that was hypothesized would exist.

Next, the data were analyzed to determine any potential differences between employed and unemployed students. The hypothesis for this analysis was that students that were employed would have higher MAI scores, as they might need better time management to balance university studies and working. To test for significant differences, the Kruskal-Wallis test was used. The test showed no significant difference between employed and unemployed students' MAI scores (Table 4.4).

Table 4.4: Kruskal-Wallis test comparing unemployed and employed students with their MAI scores.

Group Statistics								
	Dec	Proc	Cond	Plan	Info	Comp	Debu	Eval
Kruskal-Wallis P-Value	0.48	0.62	0.53	0.43	0.64	0.77	0.63	0.66

The last test administered on the data collected from the MAI was the Mann-Whitney U test. The Mann-Whitney U test is a non-parametric test used alternatively to the parametric t-test to test the null hypothesis that two sets of data are identical (Ott & Longnecker, 2001, p. 289). This test was run to determine if the descriptive results (specifically the means) of each section of the MAI were significantly different from each other. This test was conducted

between each group within each section (Figure 4.3). The test results showed that within the knowledge of cognition section of the MAI, there was no significant difference. Under the regulation of cognition section, there was significant difference between information management strategies and planning, debugging and planning, debugging and information management strategies, debugging and comprehension monitoring, and evaluation and debugging.

Figure 4.3: Mann-Whitney U test for significant difference in MAI sections.

Mann-Whitney U Test for Difference			
	Dec	Proc	Cond
Dec		0.35	0.561
Proc			0.783
Cond			

Mann-Whitney U Test for Difference					
	Plan	Info	Comp	Debu	Eval
Plan		0.001	0.029	<.001	0.331
Info			0.343	<.001	0.042
Comp				<.001	0.178
Debu					<.001
Eval					

Using a combination of the Mann-Whitney U test results and the original descriptive statistics, it was possible to rank students' awareness of their

metacognitive abilities (Table 4.5). For the knowledge about cognition section of the MAI, students were most aware of using conditional knowledge and were less aware of using procedural and declarative knowledge. For the regulation of cognition section of the MAI, music students were most aware of using debugging strategies; they were less aware of using comprehension monitoring and information management strategies; and they were least aware of using evaluation and planning.

Table 4.5: Table demonstrating the order of awareness for the categories in knowledge about cognition and regulation of cognition.

Least Aware	Less Aware	Most Aware
Planning	Comprehension Monitoring Strategies	Debugging Strategies
Evaluation	Information Management Strategies	
	Procedural Knowledge	Conditional Knowledge
	Declarative Knowledge	

For music theory pedagogy, this data in Table 4.5 informs teachers to consider specific types of approaches to teaching different topics. By knowing

students are aware they learn with debugging strategies and conditional knowledge, teachers could incorporate debugging activities into their lesson plans. The next chapter suggests specific ways to incorporate debugging strategies and conditional knowledge into learning activities.

5. CONCLUSIONS AND RECOMMENDATIONS

Introduction

The two goals of this thesis were: 1) to conduct a study that evaluates music students' self-awareness of metacognitive abilities while learning, and based on the results, 2) to propose specific activities that music theory instructors can use to leverage these metacognitive abilities in the classroom. The data analysis from the Metacognitive Awareness Inventory (MAI) lent some insight into how music students learn: the results showed an awareness of incorporating debugging strategies (i.e., the strategies used to correct errors) and conditional knowledge (i.e., knowledge about when and why to use learning procedures) in students' learning (Schraw & Dennison, 1994, p. 460). This chapter presents activities for music theory instructors to incorporate into their classrooms to utilize the metacognitive skills students are already aware of, thereby strengthening students' learning.

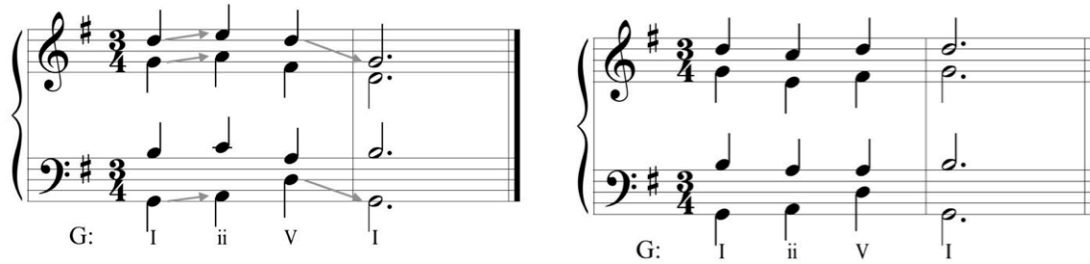
Knowledge about Cognition

The results of the MAI demonstrated that music students have a clear awareness of their use of conditional knowledge for learning and less of an awareness of using declarative knowledge and procedural knowledge for learning. Some examples of conditional knowledge (i.e., knowledge about when and why to use learning procedures) (Schraw & Dennison, 1994, p.460)

statements are "I learn best when I know something about the topic" and "I can motivate myself to learn when I need to." For teaching music theory with a focus on conditional knowledge, instructors should emphasize the conditions under which to use facts to solve a problem -- the *why* of conditions. For example, when teaching part writing rules, professors should focus on the reasons *why* part-writing rules exist instead of the simple rules (which would be declarative knowledge).

In a lesson taught on parallel intervals, for instance, instead of just stating, "Do not write parallel fifths or octaves," instructors should create a simulation of an example to help the students discover why parallel perfect intervals are not ideal. First, the instructor should play examples of part-writing containing parallel fifths and octaves (see Example 5.1a and Example 5.1b). Once the students have listened to and analyzed the examples, the professor should have the students write their own cadential examples with parallel perfect movement and without. As a class, the students can sing the examples to gain a better feel for the lack of motion that occurs when there is parallel perfect motion. Once the students have listened and sung the examples, the professor should ask students what they hear regarding parallel perfect intervals. The students might reply that there is a loss of the individuality of the voices as a result of the parallel perfect intervals. The professor could then play the examples again after the discussion to demonstrate how there is more of a feeling of movement in the

example without parallels in comparison to the cadential movement riddled with parallel movement.



a. With parallel fifths and octaves

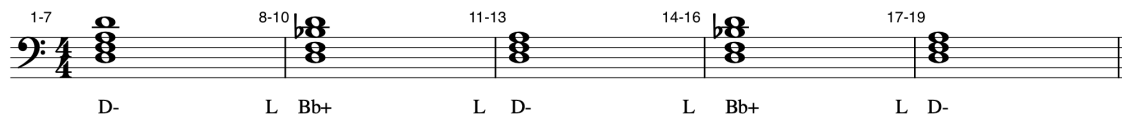
b. With no parallel motion

Example 5.1: Proper cadential movement and improper cadential movement with parallel intervals.

Students should be made aware of the metacognitive skills they utilize when learning about parallel perfect motion in comparison to proper cadential motion. In the above activity, the students were thinking about how the music felt and what was lacking when there was parallel perfect motion, Furthermore, students listened to how the music sounded when they sang the exercises, and then reached a conclusion about parallel motion from the information they obtained through exploration.

A second example of a lesson that benefits from the use of conditional knowledge is a simulation of how students might apply the rules of part-writing to composition. The instructor could ask the students to compose a piece based on a given, simplified Bach chorale bass line (see example 5.2) in the style of Bach. After the students complete the exercise, they then describe how they made their compositional decisions and how their finished composition represented Bach's style of writing. In this lesson, students should apply the parameters that Bach traditionally used in his chorale writing (e.g., harmonic progressions, modulations, proper doubling within chords, smooth lines ideal for singing). Students further should listen to and critique a peer's exercise to describe ways that they might change the composition and why they would make those changes. With modern technology, this lesson could be completed online through softwares such as Noteflight or Flat (<https://flat.io/>), which allow students to view, listen to, and critique other's compositions outside of the classroom. Students support their musical decisions with reasons based on what they have learned about part-writing rules and in their analyses of Bach chorales. To further strengthen the students' metacognitive skills, this exercise promotes metacognitive thinking that allows students to use different learning strategies, such as composition, to cement the rules they learned, aligning with Rogers's philosophy of finding ways to get past the basic vocabulary of theory and arrive at the theorizing portion of the curriculum.

third-related roots, but it does not consistently have harmonic function. I did not choose set theory because this excerpt is not atonal." By having to qualify their decision, the students deepen their understanding of why to use the analysis tools they have learned. To further strengthen the students' metacognitive skills within this exercise, the teacher could include debate based learning by presenting various musical examples and having the students debate with each other over which analytical style would best suit each piece. To challenge what students have previously learned, pieces that do not fit an exact model could be included for the debates, strengthening both the students' metacognitive skills and their analytical skills.



Example 5.3: Chordal movement with Neo-Riemannian analysis of measures 1-20 of *Etude No. 12*

A fourth activity for music theory instructors to include in their teaching that uses conditional knowledge is the “Wrapper” exercise -- an exercise used to wrap up a lesson (Lovett, 2013, p. 18). When the students turn in their homework, they

must also submit a reflection on the tools and methods they used in their assignment, as well as what aspects of the assignment were easy or difficult for them and what they plan to do in future assignments to strengthen the areas in which they were still struggling. In addition, after a quiz on the same topic is given, students reflect on the learning methods they used for the quiz. For example, after a quiz on Neapolitan chords, a student might say: "To prepare for this quiz, I went back and reviewed my homework and realized there was a muddy area where I kept making mistakes. I was writing the triad on a lowered second degree of the scale, but I was also lowering the rest of pitches of the chord a half step making the third and fifth of the triad incorrect. I am glad I realized this mistake before I took the quiz, as fixing the mistake allowed me to earn a 100 on the quiz." This "Wrapper" exercise demonstrates that the student is able to reflect on their previous work to determine an area that still needs improvement. In order to save valuable class time, the wrapper could occur outside of class on an anonymous online classroom discussion board, allowing the students to read each other's posts and possibly discover other ways they are making mistakes. This activity utilizes the metacognitive skill of reflection to help students determine their errors on their own and potentially help their peers discover their own mistakes. It also helps the students determine, through reflection, if the metacognitive skills they used to learn the material worked or not.

Regulation of Cognition

The data collected from the MAI showed students' awareness of regularly using debugging strategies in their learning, less of an awareness of regular use of comprehension monitoring strategies and information management strategies, and even less of an awareness of use of planning and evaluation strategies. Debugging strategies focus on knowing where or when there is a problem in understanding and how to correct the errors in learning. Musicians regularly employ debugging strategies when learning to play pieces for their applied lessons, ensembles, or events; they identify trouble areas in their pieces and try different strategies to untangle the cause of why a specific passage is causing them difficulties. This strategy of error detection and debugging problems can be applied to learning music theory.

For example, in the music theory classroom, debugging strategies can be emphasized in a lesson on scales. In such a lesson, students are asked to identify incorrect versions of minor scales and how these answers could have been arrived at by students (i.e., where did the student go wrong in their thinking to provide the incorrect answer). This activity uses metacognitive skills to break down possible errors to help students better understand what possible mistakes they could make and why they could make them and thus better situate the students to avoid the mistakes in the first place. In this specific exercise, the students debug potential problems made when writing scales and then fix the incorrect pitches of the scale to make the examples correct. In example 5.4, the

students could figure out that, when asked to write an F harmonic minor scale (given the key of A \flat major), the student instead wrote an F natural minor scale. The students realize that the example needed the seventh scale degree to be raised to correct the error.



Example 5.4: Incorrect F harmonic minor scale


In another example (see Example 5.5), the professor provides the students with an incorrect version of a C \sharp harmonic scale. The students figure out that the student wrote a melodic minor scale instead. In order to fix the error, the students needed to make the A \sharp an A \flat instead.




Example 5.5: Incorrect C# harmonic minor scale

A second exercise that strengthens debugging strategies is “Think, Pair, Share” -- an activity where students *think* about a question or topic posed by the teacher, *pair* with a partner to discuss their ideas, and *share* their conclusions with the class (Lyman, 1981, pp. 109-113). For example, “Think, Pair, Share” could be used by students learning to spell secondary dominant chords. Once presented with the task of writing specific secondary dominant chords (see Example 5.6), they first think about and write their answers, share their results with a partner who either confirms the correct result or helps explain to the student why the answer was wrong and how to correct the chord. For example, a student may notice their partner struggling with figuring out which key was being tonicized. In response, the student asks their partner, “How do we figure out the key for writing a secondary dominant chord?” This discussion allows the students to debug what is causing the confusion with the key of secondary dominant chords. To further deepen the students' understanding of secondary dominant chords, and to strengthen the students' metacognitive skills, the students could

devise guided questions to ask their peers such as clarification questions that help the peer rephrase the knowledge into their own words, or sequence questions, which all help both peers strengthen their understanding and think about their thinking in relation to secondary dominant chords. Finally, the students share with the class how they arrived at the correct answer and the problems they had with writing the chords.



C: V_9^6/V V

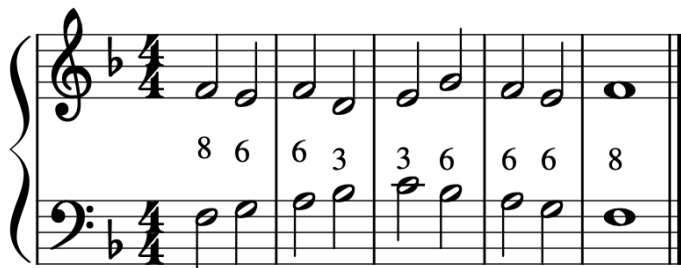


C: V_9^6/V V

Example 5.6: Student example of an incorrect and correct secondary dominant chord in the key of C major

Debugging activities could be used to help students learn counterpoint. As an example, an inquiry based teaching method might be utilized to help students discover the rules of first species counterpoint. In this activity, two examples of counterpoint are provided for the students: a successful example (Example 5.7)

and a poor example (Example 5.8). The students are aware which example was which. The students, as a class, analyze the two examples for intervals, melodic movement, harmonic progressions, and cadences. Through their examination of the successful example, students are then able, with instructor guidance, to debug the poor example, determining the reasons it is unsuccessful. Then the students, with instructor guidance, turn the things they discovered through the examples into the rules of first species counterpoint.



Example 5.7: Successful example of first species counterpoint



Example 5.8: Poor example of first species counterpoint

Conclusion

This thesis presented an overview of the research about metacognition, described the Metacognitive Awareness Inventory, presented the methodology for the administration of the survey, analyzed the results of the survey, and supplied ways to incorporate metacognition into a music theory classroom. Further research is still needed on the benefits of utilizing metacognition to teach music theory. For example, a study should be completed with the activities described here to quantitatively measure the impact such activities have on student learning. In addition, students should take the MAI multiple times to determine if their scores increase after using more metacognitive activities in their learning. While more research is needed, this thesis presented a beginning for research on metacognition in the teaching of music theory.

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APPENDIX

Appendix A: Metacognitive Awareness Inventory

Metacognitive Awareness Inventory (MAI)

Think of yourself as a **learner**. Read each statement carefully. Consider if the statement is true or false as it generally applies to you when you are in the role of a learner (student, attending classes, university etc.) Check (✓) True or False as appropriate. When finished all statements, apply your responses to the Scoring Guide.

	True	False
1. I ask myself periodically if I am meeting my goals.		
2. I consider several alternatives to a problem before I answer.		
3. I try to use strategies that have worked in the past.		
4. I pace myself while learning in order to have enough time.		
5. I understand my intellectual strengths and weaknesses.		
6. I think about what I really need to learn before I begin a task		
7. I know how well I did once I finish a test.		
8. I set specific goals before I begin a task.		
9. I slow down when I encounter important information.		
10. I know what kind of information is most important to learn.		
11. I ask myself if I have considered all options when solving a problem.		
12. I am good at organizing information.		
13. I consciously focus my attention on important information.		
14. I have a specific purpose for each strategy I use.		
15. I learn best when I know something about the topic.		
16. I know what the teacher expects me to learn.		
17. I am good at remembering information.		
18. I use different learning strategies depending on the situation.		
19. I ask myself if there was an easier way to do things after I finish a task.		
20. I have control over how well I learn.		
21. I periodically review to help me understand important relationships.		
22. I ask myself questions about the material before I begin.		
23. I think of several ways to solve a problem and choose the best one.		
24. I summarize what I've learned after I finish.		

	True	False
25. I ask others for help when I don't understand something.		
26. I can motivate myself to learn when I need to		
27. I am aware of what strategies I use when I study.		
28. I find myself analyzing the usefulness of strategies while I study.		
29. I use my intellectual strengths to compensate for my weaknesses.		
30. I focus on the meaning and significance of new information.		
31. I create my own examples to make information more meaningful.		
32. I am a good judge of how well I understand something.		
33. I find myself using helpful learning strategies automatically.		
34. I find myself pausing regularly to check my comprehension.		
35. I know when each strategy I use will be most effective.		
36. I ask myself how well I accomplish my goals once I'm finished.		
37. I draw pictures or diagrams to help me understand while learning.		
38. I ask myself if I have considered all options after I solve a problem.		
39. I try to translate new information into my own words.		
40. I change strategies when I fail to understand.		
41. I use the organizational structure of the text to help me learn.		
42. I read instructions carefully before I begin a task.		
43. I ask myself if what I'm reading is related to what I already know.		
44. I reevaluate my assumptions when I get confused.		
45. I organize my time to best accomplish my goals.		
46. I learn more when I am interested in the topic.		
47. I try to break studying down into smaller steps.		
48. I focus on overall meaning rather than specifics.		
49. I ask myself questions about how well I am doing while I am learning something new.		
50. I ask myself if I learned as much as I could have once I finish a task.		
51. I stop and go back over new information that is not clear.		
52. I stop and reread when I get confused.		

This survey and scoring guide are attributed to Schraw, G. & Dennison, R.S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*, 19, 460-475.

Metacognitive Awareness Inventory (MAI) Scoring Guide

Directions

For each **True**, give yourself **1 point** in the Score column.

For each **False**, give yourself **0 points** in the Score column.

Total the score of each category and place in box. **Read** the descriptions relating to each section.

KNOWLEDGE ABOUT COGNITION

DECLARATIVE KNOWLEDGE <ul style="list-style-type: none"> The factual knowledge the learner needs before being able to process or use critical thinking related to the topic Knowing <i>about, what, or that</i> Knowledge of one's skills, intellectual resources, and abilities as a learner Students can obtain knowledge through presentations, demonstrations, discussions 		DECLARATIVE KNOWLEDGE		SCORE
		5. I understand my intellectual strengths and weaknesses.		
		10. I know what kind of information is most important to learn.		
		12. I am good at organizing information.		
		16. I know what the teacher expects me to learn.		
		17. I am good at remembering information.		
		20. I have control over how well I learn.		
		32. I am a good judge of how well I understand something.		
		46. I learn more when I am interested in the topic.		
		TOTAL		8
PROCEDURAL KNOWLEDGE <ul style="list-style-type: none"> The application of knowledge for the purposes of completing a procedure or process Knowledge about <i>how</i> to implement learning procedures (e.g., strategies) Requires students know the process as well as when to apply process in various situations Students can obtain knowledge through discovery, cooperative learning, and problem solving 		PROCEDURAL KNOWLEDGE		SCORE
		3. I try to use strategies that have worked in the past.		
		14. I have a specific purpose for each strategy I use.		
		27. I am aware of what strategies I use when I study.		
		33. I find myself using helpful learning strategies automatically.		
		TOTAL		4
		CONDITIONAL KNOWLEDGE		SCORE
		15. I learn best when I know something about the topic.		
		18. I use different learning strategies depending on the situation.		
		26. I can motivate myself to learn when I need to.		
		29. I use my intellectual strengths to compensate for my weaknesses.		
		35. I know when each strategy I use will be most effective.		
		TOTAL		5

This survey and scoring guide are attributed to Schraw, G. & Dennison, R.S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*, 19, 460-475.

REGULATION OF COGNITION

PLANNING <ul style="list-style-type: none">Planning, goal setting, and allocating resources <i>prior</i> to learning INFORMATION MANAGEMENT STRATEGIES <ul style="list-style-type: none">Skills and strategy sequences used to process information more efficiently (e.g., organizing, elaborating, summarizing, selective focusing) COMPREHENSION MONITORING <ul style="list-style-type: none">Assessment of one's learning or strategy use DEBUGGING STRATEGIES <ul style="list-style-type: none">Strategies to correct comprehension and performance errors EVALUATION <ul style="list-style-type: none">Analysis of performance and strategy effectiveness after a learning episode			PLANNING <ul style="list-style-type: none">4. I pace myself while learning in order to have enough time.6. I think about what I really need to learn before I begin a task.8. I set specific goals before I begin a task.22. I ask myself questions about the material before I begin.23. I think of several ways to solve a problem and choose the best one.42. I read instructions carefully before I begin a task.45. I organize my time to best accomplish my goals. <div>TOTAL</div>		SCORE <div>7</div>
INFORMATION MANAGEMENT STRATEGIES		SCORE	COMPREHENSION MONITORING		SCORE
9. I slow down when I encounter important information.			1. I ask myself periodically if I am meeting my goals.		
13. I consciously focus my attention on important information.			2. I consider several alternatives to a problem before I answer.		
30. I focus on the meaning and significance of new information.			11. I ask myself if I have considered all options when solving a problem.		
31. I create my own examples to make information more meaningful.			21. I periodically review to help me understand important relationships.		
37. I draw pictures or diagrams to help me understand while learning.			28. I find myself analyzing the usefulness of strategies while I study.		
39. I try to translate new information into my own words.			34. I find myself pausing regularly to check my comprehension.		
41. I use the organizational structure of the text to help me learn			49. I ask myself questions about how well I am doing while learning something new.		
43. I ask myself if what I'm reading is related to what I already know.					
47. I try to break studying down into smaller steps.					
48. I focus on overall meaning rather than specifics.					
TOTAL		10	TOTAL		7
DEBUGGING STRATEGIES		SCORE	EVALUATION		SCORE
25. I ask others for help when I don't understand something.			7. I know how well I did once I finish a test.		
40. I change strategies when I fail to understand.			19. I ask myself if there was an easier way to do things after I finish a task.		
44. I re-evaluate my assumptions when I get confused.			24. I summarize what I've learned after I finish.		
51. I stop and go back over new information that is not clear.			36. I ask myself how well I accomplish my goals once I'm finished.		
52. I stop and reread when I get confused.			38. I ask myself if I have considered all options after I solve a problem.		
			50. I ask myself if I learned as much as I could have once I finish a task.		
TOTAL		5	TOTAL		6

Appendix B: Demographics Form

The following questions are demographic questions.

Indicate your gender:

- ☐ Male
- ☐ Female
- ☐ Other
- ☐ I do not wish to respond

Indicate your age.

Indicate your degree.

- ☐ Bachelor of Music
- ☐ Bachelor of Arts
- ☐ Master of Music
- ☐ Artist Certificate
- ☐ Other

Are you a double major?

- ☐ Yes
- ☐ No

Indicate your primary major.

- ☐ Music Education

- ☐ Performance
- ☐ Studio Music & Jazz
- ☐ Theory
- ☐ Composition
- ☐ Music & Culture
- ☐ Sacred Music
- ☐ Musicology (graduate only)
- ☐ Instrumental Conducting (graduate only)
- ☐ Choral Conducting (graduate only)
- ☐ Collaborative Piano (graduate only)
- ☐ Other

Indicate your second major.

- ☐ Music Education
- ☐ Performance
- ☐ Studio Music & Jazz
- ☐ Theory
- ☐ Composition
- ☐ Music & Culture
- ☐ Sacred Music
- ☐ Musicology (graduate only)
- ☐ Instrumental Conducting (graduate only)
- ☐ Choral Conducting (graduate only)
- ☐ Collaborative Piano (graduate only)
- ☐ Other

Indicate your primary instrument or voice.

Indicate your level in school.

- ☐ Undergraduate - first year
- ☐ Undergraduate -second year
- ☐ Undergraduate - third year
- ☐ Undergraduate - fourth year
- ☐ Undergraduate - fifth year and up
- ☐ Graduate student - first year
- ☐ Graduate student - second year
- ☐ Graduate student - third year and up
- ☐ Non-degree seeking student
- ☐ Other

What was your high school GPA?

- ☐ 4.0 or higher
- ☐ 3.6-3.9
- ☐ 3.1-3.5
- ☐ 2.6-3.0
- ☐ 2.0-2.5
- ☐ below 2.0

What is/was your undergraduate GPA?

- ☐ 4.0
- ☐ 3.6-3.9
- ☐ 3.1-3.5
- ☐ 2.6-3.0
- ☐ 2.0-2.5
- ☐ Below 2.0

☐ Not Applicable

What is your graduate GPA?

- ☐ 4.0
- ☐ 3.6-3.9
- ☐ 3.1-3.5
- ☐ 2.6-3.0
- ☐ 2.0-2.5
- ☐ Below 2.0
- ☐ Not Applicable

How many credit hours are you currently enrolled in?

What is your current employment status (including any GTA, GA, GRA)

- ☐ Unemployed
- ☐ works 10 or less hours a week
- ☐ works 11-15 hours a week
- ☐ works 16-20 hours a week
- ☐ work 21-25 hours a week
- ☐ works 26-30 hours a week
- ☐ works 31-39 hours a week
- ☐ Full time employee

Additional comments:

Appendix C: Email for Music Coordinators

Greetings Undergraduate and Graduate Music Coordinators,

I am emailing you to request that you forward this survey and email to all music majors at the University of Tennessee. This survey is a key component for my thesis, *Metacognition in the Music Theory Classroom. This survey will measure students' metacognition skills and may benefit their academic performance.* This survey needs to be sent three times over the span of three weeks to ensure optimal student participation. Thank you very much for your help.

Jillian Vogel

Appendix D: Email for Student Recruitment

Greetings music students:

I am hoping you can spare a few minutes to participate in my survey on thinking about thinking and the learning process.

The purpose of this survey is to measure music students' metacognitive skills to determine what skills students have at certain levels in their education to discover if that correlates with their academic achievement. This survey is part of my master's thesis. The results may be presented at a future conference.

By completing this survey, you are giving your permission to use the information obtained, which will not identify you, in my thesis and at future conference presentations.

The Qualtrics survey can be taken on any personal computer and will take approximately 10 minutes to take. After you complete the survey, your results will be shown to you, which may be able to help your learning process in the future. The link to the survey is included in this email.

Thank you very much for your help.

Jillian Vogel

Master of Music Theory Candidate University of Tennessee

Appendix E: Consent Form

Block 1

I am asking you to be in this research study because you are an undergraduate or graduate student enrolled in a music course at The University of Tennessee. You must be age 18 or older to participate in the study. The information in this consent form is to help you decide if you want to be in this research study. Please take your time reading this form and contact the researcher to ask questions if there is anything you do not understand.

Why is the research being done?

The purpose of this study is to measure music students' metacognitive skills to determine what skills students have at certain levels in their education to discover if that is correlated to their academic achievement.

I am giving you the information below so you can decide if this relationship will affect your decision to be in this study:

The risks in this study are minimal. The only possible risk is that your information is leaked. We do not anticipate this happening.

What will I do in this study?

If you agree to be in this study, you will complete an online survey. The survey includes questions about your thinking and how you learn and should take you about 10 minutes to complete. You can skip questions that you do not want to answer.

Can I say “No”?

Being in this study is up to you. You can stop up until you submit the survey. After you submit the survey, we cannot remove your responses because we will not know which responses came from you. Either way, your decision won't affect your grades, your relationship with your instructors, or standing with the School of Music.

Are there any risks to me?

For any online survey, there is a minimal risk that your information can be leaked. We do not anticipate this occurring.

Are there any benefits to me?

There is a possibility that you may benefit from being in the study, but there is no guarantee that will happen. Possible benefits include discovering the ways you think about thinking and learning, which may help you in your academic studies. Even if you don't benefit from being in the study, your participation may help us to learn more about thinking about thinking. We hope the knowledge gained from this study will benefit others in the future.

What will happen with the information collected for this study?

The survey is anonymous, and no one will be able to link your responses back to you. Your responses to the survey will not be linked to your computer, email address or other electronic identifiers. Please do not include your name or other information that could be used to identify you in your survey responses. Information provided in this survey can only be kept as secure as any other online communication. Information collected for this study will be published and possibly presented at scientific meetings.

Will I be paid for being in this research study?

You will not be paid for being in this study.

Who can answer my questions about this research study?

If you have questions or concerns about this study, or have experienced a research related problem or injury, contact the researchers, Jillian Vogel at dvg665@vols.utk.edu or Dr. Barbara Murphy at bmurphy@utk.edu.

For questions or concerns about your rights or to speak with someone other than the research team about the study, please contact:

Institutional Review Board
The University of Tennessee, Knoxville
1534 White Avenue
Blount Hall, Room 408
Knoxville, TN 37996-1529

Phone: 865-974-7697

Email: utkirb@utk.edu

Statement of Consent

I have read this form, been given the chance to ask questions and have my questions answered. If I have more questions, I have been told who to contact. By clicking the “I Agree” button below, I am agreeing to be in this study. I can print or save a copy of this consent information for future reference. If I do not want to be in this study, I can close my internet browser.

- ☐ I am 18 years or older and I consent to take this survey.
- ☐ I am 17 years or younger and/or I do not consent to take this survey.

VITA

Jillian Vogel attended Austin Peay State University for her undergraduate degree in music education, where she matriculated in 2018. Post matriculation, she attended the University of Tennessee, Knoxville and is a Master of Music in music theory candidate. While attending the University of Tennessee, Knoxville, she focused on research in the areas of metacognition, music pedagogy, music and feminist studies, and Neo-Riemannian theory. Her research interests have led her to present at five conferences while obtaining her Masters of Music degree. She plans to continue her research on metacognition and ultimately create a music theory textbook that incorporates the results of her research.